Australian Butterflies.

OLLIFF.

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Prof. F. McCoy, F.R.S.
With the writer's Compliments.

Museum Victoria
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PUBLISHED BY THE NATURAL HISTORY ASSOCIATION OF NEW SOUTH WALES.

AUSTRALIAN BUTTERFLIES:

A Brief Account of the Native Families,

WITH A CHAPTER ON

COLLECTING & PRESERVING INSECTS.

NATIONAL MUSEUM MELBOURNE

BY

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WITH ILLUSTRATIONS ON WOOD BY J. M. CANTLE.

PRICE ONE SHILLING.

Sydney:
BATSON & CO., PRINTERS, 195 CLARENCE STREET.

1889.

Eager he looks; and soon to glad his eyes,
From the sweet bower by nature formed, arise
Bright troops of virgin moths and fresh born butterflies;
Who broke that morning from their half-year's sleep,
To fly o'er flowers where they were wont to creep.

—CRABBE.

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PREFACE.

The following short account of the Butterflies of Australia, written at the request of the Committee of the Natural History Association of New South Wales, is published in the hope that it may lead some residents in the country to interest themselves in the Butterflies of their districts, and thus to bring about an increase in our knowledge of the habits, life-histories, and distribution of these interesting creatures. To assist in this object, Mr. J. M. Cantle has placed his pencil at the service of the Association, with the result that I have had at my disposal a series of characteristic drawings, of life-size, showing the different types of Butterflies found in this country.

I should add that the substance of the following pages has already appeared in the columns of the Sydney Mail—*to the proprietors of which paper the Association is indebted for the engraving of the woodcuts.*

A. Sidney Olliff.

Australian Museum :
February 1st, 1889.

IN PREPARATION BY THE SAME AUTHOR.

A CHECK-LIST OF THE AUSTRALIAN BUTTERFLIES,

CONTAINING REFERENCES, HABITATS, AND FULL SYNONYMY.

N.B.—As the Author is engaged in collecting information concerning the geographical distribution of the Australian Butterflies, and intends publishing, at some future time, a detailed report on the subject, somewhat after the plan of Mr. H. J. Fust's paper on the "Distribution of Lepidoptera in Great Britain and Ireland" (Trans. Ent. Soc., London, 1868), he would be happy to receive specimens from collectors in all parts of Australia, and would willingly send their names, or other specimens in exchange, where this is desired; or, if preferred, he would purchase any specimens sent in good condition. To the Lepidopterists of the sister colonies an appeal is made for information, especially for local lists of species, with or without the seasons of their appearance. It is hardly necessary, perhaps, to add that any assistance rendered will receive full acknowledgment. Communications may be addressed direct to the Author, or to the care of the Hon. Secretary, Natural History Association of New South Wales, School of Arts, Sydney.

AUSTRALIAN BUTTERFLIES.

It is not too much to say, that the absence of a treatise on the native species, in a convenient form, has deterred many who delight in the study of nature from turning their attention to those sunny creatures called butterflies, of which we have so many beautiful varieties in this country. The subject is one which has long had attractions for the lover of nature—whether artist, poet, or naturalist—as an array of names famous in the world of literature and art will amply testify. To the scientist, the smaller and more defenceless forms of life offer special advantages for the study of some important problems—such as the variation and distribution of species—on account of their vast numbers and limited powers of locomotion. Insects especially, from the readiness with which they breed in confinement, and the short duration of their lives, which renders it possible to trace the history of one kind through many successive generations, have afforded the material for many interesting experiments, particularly of evolutionists and others endeavouring to throw light on the little understood laws affecting heredity and variation. Apart from the scientific aspect of the subject, the formation of a collection of butterflies, and the observation of their habits and economy, is a never-ending source of instruction to those dwellers in the country who devote some of their leisure to the study of nature's works.

NATIONAL MUSEUM MELBOURNE

No ambitious plan is followed in this paper. It is not even my intention to attempt to describe the structure of butterflies in general, or the nature of their life histories. The subject is too large for treatment here; but I purpose giving a general description of the families, and an account of the native species, especially of the varieties likely to be frequently met with, and those of which our knowledge is still incomplete. In this way it is hoped that attention will be drawn to the subject, and that by the formation of local collections, and the observation of the food-plants, life-histories, and the season of each species, not to mention the discovery of new ones, a valuable addition will be made to our knowledge of the group, and the work of preparing a handbook to our native species rendered possible in the future.

Butterflies (*Rhopalocera :* club-horns), as everybody knows, have four stages of existence—the egg, the larva or caterpillar, the pupa or chrysalis, and the adult or perfect insect. Together with the moths (*Heterocera :* various horns), they form the order Lepidoptera (scale-wings). The distinction between the two groups is based on the form of the antennæ, or horns, as implied in their names, but the characteristic is not very reliable, owing to a few aberrant moths (not Australian) possessing clubbed horns. Butterflies, however, usually have straight clubbed horns, a slender body, and ample wings, which when closed are carried erect over the back. The horns are never folded under the wings in repose, and are usually erect. Finally, butterflies are never night-fliers.

The most generally adopted, and indeed the only rational, classification of the butterflies is that proposed by Mr. H. W. Bates in 1861, and founded on a consideration of the early stages as well as of the structure of the perfect insects. Briefly, the system may be summarised as follows :—

ORDER LEPIDOPTERA (BUTTERFLIES AND MOTHS).

Rhopalocera (Butterflies—Day-fliers).

Fam. 1, Nymphalidæ : Front legs imperfect in both sexes ; in female wanting the tarsal claws ; in male the fore tarsi (feet) quite rudimentary, consisting of one or two spineless joints. Chrysalis suspended by the tail.

Sub-Fam. 1, Danainæ : Caterpillars smooth, with fleshy processes. Fore-wing of the perfect insect with sub-median nervure double at its origin.

Sub-Fam. 2, Acræinæ : Caterpillars studded with branched spines. Palpi of the perfect insect thick and scantily clothed with hair.

Sub-Fam. 3, Nymphalinæ : Lower disco-cellular nervule, at least of the hind-wing, more or less atrophied.

Sub-Fam. 4, Satyrinæ : Caterpillars with bifid tails, spineless. Palpi of perfect insect generally compressed and fringed with long hair-scales.

Fam. 2, Erycinidæ : Six perfect legs in female, four in male, the anterior tarsi consisting only of one or two joints and spineless. Chrysalis suspended freely by the tail, secured rigidly by the tail, or secured by the tail and with a girdle across the middle.

Fam. 3, Lycænidæ : Six perfect legs in female, four in male, the anterior tarsi wanting one or both of the tarsal claws, but

densely spined beneath. Chrysalis secured by the tail and a girdle across the middle.

Fam. 4, Papilionidæ : Six perfect legs in both sexes. Chrysalis secured by the tail and a girdle across the middle.

Sub-Fam. 1, Pierinæ : Abdominal margin of the hind-wing not curved inwards.

Sub-Fam. 2, Papilioninæ : Abdominal margin of the hind-wing curving inwards.

Fam. 5, Hesperiidæ : Six perfect legs in both sexes ; hind tibiæ, with few exceptions, having two pair of spurs. Chrysalis secured by many threads, or enclosed in a slight cocoon.

NYMPHALIDÆ.

This family includes the whole of the great division of butterflies in which the forelegs of the perfect insect are undeveloped, having the foot, or tarsus, rudimentary in both sexes.

Danainæ.

The caterpillar is stout, cylindrical towards the head, usually furnished with tentacula. Chrysalis often with bright metallic colouring.

The Danainæ are insects of large size, of slow flapping flight when undisturbed, and of the most fearless demeanour. They enjoy immunity from the attacks of insectivorous birds and reptiles, which may account for their fearlessness, and are said to owe this freedom to the presence of pungent odours in the juices of their bodies. Moreover they are tough and leathery, and have great tenacity of life. The metropolis of the Danainæ is the Indo-Malayan region, but species of the group are scattered very widely, and its distribution may be said to be world-wide.

In Australia there are three genera belonging to this group—namely, Danais, Euplœa, and Hamadryas. The first of these is represented by six species, of which the most conspicuous is *Danais plexippus*, Linn., the subject of our illustration. In colour this species is orange red, with black markings. It is now almost cosmopolitan in its range, having made its way from the New world to the Old. Its gradual dispersion within recent times, and, as it were before our eyes, as pointed out by Mr. Distant, is one of the most remarkable instances of insect distribution known to us. It was first recorded as occurring in Australia by Mr. Miskin, who found it in Queensland in 1870,

and, in the same year, it is said to have been seen in Lord Howe Island, in Melbourne, at the Clarence River, and subsequently it was observed in many other localities. It is generally thought that 1870 was the first year of its appearance here, but Dr. Ramsay informs me that he is positive that he saw the species at

DANAIS PLEXIPPUS, Linn. (Male.)
Red Danais Butterfly.

Ashfield, near Sydney, as early as the year 1856. Observers are so scattered, that the exact date of the insect's arrival can only be a matter of conjecture. It is evident, however, that the species did not obtain a firm foot-hold until 1870 or thereabouts. It feeds on the cotton weeds, *Asclepias curassavica* and *Gomphocarpus fruticosus*, two introduced plants, and is now one of the most familiar Sydney butterflies.

Besides the Danais of the cotton-weed, we have in Australia several fine species of the genus which are truly indigenous. Among these the black and pearly blue form, known as *Danais hamata*, Macleay, is conspicuous from its large size and distinctive markings. It feeds on various climbing plants, and ranges from Cape York to Shoalhaven, but I am not aware of its presence further south. About Sydney it is occasionally met with, even in the midst of the town, for I have seen it in the Botanic Gardens, but it is by no means abundant. Of the other species little need be said. Our lesser red species appears to be identical with the *Danais petilia*, Stoll. *Danais affinis*, Fabr., an abundant Queensland species, has been captured as far south as the Hunter River, and there is another red species, with black veins, at present only known to us from North-west Australia.

The genus Euplœa is represented in the north by about 11 species. As far as I am aware, only two—*Euplœa corinna*, Macleay, and *Euplœa darchia*, Macleay—have been found in

Danais hamata, Macl.
Attractive Danais Butterfly.

New South Wales; the former occurs in Sydney and the latter has been caught at least on one occasion in the neighbourhood of Newcastle.

Hamadryas, the only other Australian genus of Danainæ, is represented by a single species, *Hamadryas zoilus*, Fabr., which is also a Northern butterfly. It occurs in New Guinea, and according to Dieffenbach in New Zealand; but the latter locality is probably erroneous.

In this group of butterflies the males have curious patches or "sexual marks" on the wings, and have besides the power of protruding two long brushes of hair from their anal extremity or tail, which have been thought to disseminate the evil smell which renders the insects unpalatable to birds. These "sexual marks" have been made use of by systematists for subdividing the Danainæ into minor groups, and some interesting observations have been made on the singular resemblance which the species in certain of these minor groups bear to those in allied minor groups. The advantageous or protective resemblance which one species bears to another has long been known as mimicry, the name applied to it in a metaphorical sense by Mr. Bates, who first observed the phenomenon in certain South American butterflies. There are two ways in which mimicry may benefit a species. It may help it to escape observation, or

it may help it to deceive its prey. In the butterflies the former is apparently the object of the mimicking species. Briefly, the phenomenon consists in the following relation. A certain butterfly possesses some special means of defence, such as a powerful and disagreeable odour, a nauseous taste, &c. Some other butterfly, inhabiting the same region and not itself provided with a special means of defence, closely resembles the first in all external points of colour and form, though often quite different in structure, and thus deceives its enemies. In the case of the Danainæ, the resemblance is between related groups, and not between species widely different in structure. This special form of mimicry has been the subject of much recent discussion.

Acræinæ.

The caterpillar is cylindrical, almost of the same thickness throughout its length, and beset with rigid bristles or spines; head smooth. Chrysalis narrow, with the sides of the thorax angulated, and the back somewhat prominent; head sometimes rounded, sometimes bluntly bifid.

The sub-family Acræinæ is distinguished by having the wings elongate; the hind-wing free from the abdomen or body along its inner margin and not channeled to receive it. The claws of the tarsi are simple. They have a slow, sailing flight, and settle frequently. Like the Danainæ, they appear to be free from the attacks of birds, and some of them would appear to be offensive to the carnivorous Mantidæ, a group of insects allied to the grasshoppers, which in Europe are called praying mantises and in America soothsayers and prophets. The interesting experiments made at Calcutta by Mr. de Nicéville certainly lead to this conclusion. Many species of butterflies believed to be distasteful to birds were offered to a praying mantis and immediately seized, but the creature could not be induced to touch the Acræinæ. The headquarters of the group is in Africa. One or two are known from India and Eastern Asia, and in the new world they are represented by numerous species. Some of them are very local in their range, but where they do occur they are usually very abundant. I have myself seen many hundreds of them in New South Wales settled on their food-plants basking in the sunshine. We have, I believe, only a single species, the *Acræa andromacha*, Fabr., which extends its range into New Guinea, Fiji, and Samoa. Its fore-wings are transparent, with dusky markings, and the hind-wings opaque creamy white marked with brown. It is frequently seen in Sydney, and its caterpillar—a yellowish-brown creature armed with branched spines—is a familiar object on passion vines (*Passiflora Herbertiana, Tacsonia Mortii, &c.*) in

the eastern suburbs. The caterpillar, like the perfect insect, lives in companies. Pastor Wallengren, a Swedish naturalist, has published an account of a second Australian species, named

ACRÆA ANDROMACHA, Fabr.
Glass-wing Butterfly.

Acræa theodote, but it is said to be mythical, probably an extra-Australian species with a wrong locality. The singular abdominal plate or pouch with which the females of many of the species of Acræa are provided is strongly developed in our native form. The structure is also found in Parnassius, a genus of Papilionidæ, but its functions are by no means thoroughly understood.

NYMPHALINÆ.

There are two very distinct types of caterpillars in this sub-family—one in which the animal is long, cylindrical, armed with spines or elongated tubercles and bristles, and the other in which the creature is smooth and slug-like, with non-retractile horns on the head. Argynnis, Pyrameis, Neptis, &c., are examples of the former group, and Charaxes of the latter. The chrysalides belonging to the caterpillars of the first group are usually provided with angular projections at the sides, and are frequently marked with brilliant metallic spots; those of the second group usually lack both these features. The perfect insects have no anal tufts of hair in the males, and most of them have the juices of their bodies free from acridity. When at rest they generally sit with their wings widely spread open.

The sub-family Nymphalinæ is found throughout the world, even extending its range into the Arctic regions, but it attains

its greatest development in tropical and semi-tropical countries. In Australia it is represented by about 25 species, comprised in 15 genera. They are bold, sunshine-loving insects, and usually frequent gardens, fields, and open country. The group is remarkable for its diversity in form and structure, and, with a few exceptions, for the constancy of the markings of the various species. In most cases the sexes are not greatly differentiated. One of the most conspicuous of our native genera is Cethosia, represented by two species, *Cethosia cydippe*, Linn., and *C. Lamarckii*, Godt., which are found in Northern Queensland.

CETHOSIA CYDIPPE, Linn.
The Northern Cethosia.

C. cydippe is rich fulvous red above, with a broad purplish outer border, and a triangular white patch on the fore-wing. A remarkable feature of the species, and indeed of the genus, is the deep scalloping of the hind-wing. As far as I know the early stages of our native Cethosiæ have not yet been observed.

The genus Cynthia, containing a single fine Australian species, *C. Ada*, M. Butl., is found throughout Queensland, and is said to extend as far south as the Clarence River, but its home is the country between Cape York and Rockingham Bay. Messaras, represented by *M. madestes*, Hew., a species confused in many colonial collections with an Amboynese species, from which it differs in having a broad orange band across the hind as well as the fore-wing, is almost identical in its range. A single species of Atella, a genus of small extent, occurring in Africa, India, and the Malay Archipelago, has recently been described under the name *A. propinqua* by Mr. Miskin. It was found originally at

DOLESCHALLIA AUSTRALIS, Feld.
Leaf-wing Butterfly.

D. AUSTRALIS (Underside).

matter of extreme difficulty. Some Indian species of an allied genus—Kallima—are even more exact representations of leaves. It has been said that a series of specimens could be selected

Rockingham Bay, and I have since recorded it from the slopes of Mount Bellenden-Ker. The next genus is Argynnis, belonging to the group of butterflies known as "fritillaries," which is remarkable for having the undersides of the perfect insects marked with

ARGYNNIS INCONSTANS, Butl.
Australian Fritillary.

silvery spots. The Australian species, *A. inconstans*, Butl., is common in Queensland, and is sometimes seen as far south as the Hunter River. Above it is fulvous brown in colour, marked with black; beneath, the hind-wings are ornamented with ill-defined silvery spots. Closely allied to this are the Painted Lady, *Pyrameis cardui*, Linn., and the Australian Admiral, *P. itea*, Fabr., belonging to the same genus. The former is almost ubiquitous, having extended its range into the most remote oceanic islands. Normally it is a very constant species, but in Australia and New Zealand a form has developed with large blue-centred spots on the hind-wings, to which the name *P. Kershawi* has been given by Professor M'Coy; and another singular variety, which I have recently recorded under the name *P. suffusa*, has been found on the heights of Bombala. The other species—the Australian Admiral—is found throughout Australia and New Zealand, as well as in Norfolk and Lord Howe Islands. It is closely allied to the Red Admiral, *P. atalanta*, Linn., familiar to every English school-boy. Besides two widely-distributed species of Junonia, a single species of the northern genera Precis, and Rhinopalpa, we have a species belonging to the "Leaf-wing" butterflies, a group of singular interest to the naturalist, since it offers the best evidence of the truth of protective assimilation. The upper side of our native form, which is called *Doleschallia australis*, Feld., is reddish brown, bordered with black. When the insect is settled on the stem of a plant with its wings folded over its back, it resembles a leaf, thus rendering its detection a

showing extreme variation in colour, and bearing analogy to the autumnal tints of leaves in various stages of decay. Our Australian species varies considerably in the colouring of the underside, but not nearly to this extent.

Hypolimnas or Diadema, the next genus with which we have to deal, comprises some of the most variable of butterflies; indeed the females of several species vary so much in colour and marking that it is almost impossible to find two alike. The genus is found in Africa, Madagascar, and throughout the Indo- and Austro-Malayan regions, even occurring in many of the most remote islands of the South Seas. Although in certain species the variation appears to correspond in some measure to geographical limits, it does not seem—as some stay-at-home describers of butterflies would have us suppose—that each island, or each group of islands, must necessarily have its peculiar form. Until some observer makes a detailed study of a large series from various and accurately-ascertained localities, as suggested by Mr. Wallace, we cannot hope to obtain a just view as to the number and range of the species. In Australia we have, I believe, three well-marked forms—*Hypolimnas alimena*, Linn., *H. bolina*, Linn. (both common species), and *H. misippus*, Linn., which I have only seen from King Sound, in North-west Australia. Of these, *H. bolina*—I use the name in Wallace's sense—and *H. misippus*, have a range extending from the South Pacific to continental India and Africa; among many other insular localities, the former is found in Norfolk and Lord Howe Islands.

Neptis contains about five Australian species, of which *N. Shepherdi*, Mre., is the most familiar, and *N. consimilis*, Bois., the most conspicuous. The genus has so great a resemblance to Hamadryas, of the sub-family Danainæ, that one of the species, *Neptis Praslini*, Bois., has been redescribed as belonging to that genus under the name *Hamadryas Moorei*.

Symphædra, represented by *S. æropus*, Linn., is only known to me from description, and the next genus, Mynes, containing a single species, *M. Geoffroyi*, Gu., is one of our most singular northern forms. It is subject to great variation, particularly in the markings of the underside.

Allied to Doleschallia and the neighbouring genera is the magnificent Tailed Emperor, *Charaxes sempronius*, Fabr., which is figured in our illustration. This fine species is rare in the interior, but not uncommon in the coast districts of New South Wales and Queensland, where it is one of the most conspicuous butterflies on account of its large size and the boldness and rapidity of its flight. The insects of the genus Charaxes have a wide range,

extending from Southern Europe to Cape Colony, and eastward throughout India and the Malay Archipelago ; in the Pacific their distribution is somewhat restricted, but they are represented in New Guinea and Fiji. The Australian species—*C. sempronius*—sometimes measures as much as 4½in. across the wings. Above

CHARAXES SEMPRONIUS, Fabr.
Tailed Emperor, and a Variety of its Caterpillar.

it is creamy white in colour with black markings ; beneath it is silvery white, marked with brick red and black, and a row of orange spots on the margins of the hind-wings. The sexes do

not differ materially, and the only points in which the species displays any important variation are the width of the black border and the size of the marginal spots on the fore-wings.

The caterpillar of *C. sempronius* appears to feed on various plants belonging to the genus Acacia, having a special liking for the "white wattle" and also for the camphor tree. In the suburbs of Sydney it may often be seen feeding on *Brachychiton populneus*. When fully grown it is a long slug-like creature of a bright bluish green colour, with a pinkish bicuspid tail, and bearing on its head four horns, which give it a somewhat formidable appearance. Usually the caterpillar has two yellow lunules or rings, edged with purple, encircling the middle of its body; but sometimes only one of these is present. A singular variety (see illustration) of a pinkish green colour, with a series of 10 or 11 lunules, has been found on more than one occasion, but I am not aware that it has been successfully reared. One which I found died before reaching maturity. It would be a matter of great interest to observe if the perfect insects produced by these very dissimilar caterpillars are, or are not, identical in all respects. As the form with the series of lunules has never to my knowledge been reared, I cannot of course positively assert that it belongs to *C. sempronius*, but there can hardly be a doubt on the subject, as no other butterfly is found in Sydney to which such a caterpillar could be assigned.

Satyrinæ.

In this sub-family the caterpillar is generally woolly and attenuated at the anal extremity, which is furnished with two more or less pointed prominences; the head rounded, emarginate, bifid, or spined. Chrysalis short and cylindrical, without metallic markings; the sides never very strongly angulated.

The insects of this group are more numerous in temperate climates than in tropical or semi-tropical regions, hence they are better represented in Tasmania, Victoria, and the southern parts of New South Wales, than in Queensland or the hotter latitudes of the North. Most of the species are brownish or fuscous in colour, with fulvous or whitish markings, and are usually ornamented on the underside with ocellated spots. They have a weak and irregular flight, and affect low-growing herbage, often flying in dull or even rainy weather, when no other butterflies are to be found on the wing. Of the genera which are represented within the limits of our fauna, Melanitis, containing a single widely distributed species, *M. leda*, Linn., is remarkable for its falcate fore-wings. It is found throughout

India, the Malay Peninsula and Archipelago, and in Australia as far south as Port Hacking. The allied genus Xenica is an essentially Australian one, no species of the group being found elsewhere. Eight species are now known, of which two—*X. achanta*, Don., and *X. Klugii*, Gn., are common in the Southern colonies. In Tasmania, *X. Klugii*, *X. lathoniella*, Westw., *X. hobartia*, Westw., and *X. leprea*, Hew., all occur, the two former in great abundance. *X. orichora*, Meyr., is found on the slopes of Mt. Kosciusko, and *X. Kershawi*, Misk., in Gippsland. In the Blue Mountains I have taken *X. hobartia*, and *X. lathoniella* is found in the Liverpool Plains district, where specimens were

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Xenica lathoniella, Wtw.
Silvery Xenica.

captured in company with the Northern form of *X. Kershawi*, which I have named *X. Ella*. Our illustration represents the upper and under side of *X. lathoniella*. It is a bright reddish yellow colour above, marked with brown; beneath the hind-wing is richly ornamented with silver. Epinephile, a genus of wide range, is represented by four species in Australia, of which *E. abeona*, Don., is a familiar southern species. The other species are much rarer. *E. Joanna*, Butl., is found in the Liverpool Plains, *E. Rawnsleyi*, Misk., near Brisbane, and *E. Helena*, Oll., at Mount Bellenden-Ker, and the Barron Falls, near Cairns. It is a dull brown insect, with sulphur-coloured markings on the fore-wings, and is nearly related to *E. abeona*.

The genus Heteronympha, containing seven species, has its headquarters in South and South-east Australia. The most common and wide-spread species is *H. merope*, Fabr., which ranges from Champion Bay, West Australia, to the east coast. It is also found throughout Tasmania, not excepting the upper slopes of Mount

Wellington. *H. cordace*, Hübn., and *H. philerope*, Bois., both well-known Victorian species, are found as far north as the Liverpool Plains, but as far as I know the only species of the

EPINEPHILE HELENA. Oll.
Mountain Brown.

genus which is not found in the Southern colonies is *H. Digglesi*, Misk., described from the vicinity of Brisbane. *H. mirifica*, Butl., is a very local species, but usually abundant where it occurs. The banks of the Hunter River, near Newcastle, and the valley of the Nepean, above Penrith, are localities in which it has been found in great abundance. *H. Duboulayi*, Butl., is a common West Australian form. The other genera of the sub-family are Mycalesis, Ypthima, and Hypocysta, the former confined to the warmer latitudes of the north, the last with a wide distribution. About Sydney *Hypocysta irius*, Fabr., and *H. euphemia*, Dbl., are familiar species.

LIBYTHEA ~~MYRICHA, Godt.~~ x
The Eastern Libythea.

Nicéville Oll. P.L.S.N.S.W.
" Vol. 6. p. 28. 1891.
Geoffroyi, Godt.

ERYCINIDÆ.

This family includes those butterflies in which the forelegs are more perfectly developed in the female than in the male. Compared with those of the Nymphalidæ, they are more perfect in every respect.

Only one sub-family—the Libythæinæ—is represented in Australia, and of this only a single species is known. The group is very widely distributed, and is remarkable for the peculiar structure of the palpi, which are beak-like, and greatly protruded. The caterpillar is cylindrical, and covered with fine pubescence ; chrysalis short, suspended by the tail.

The only species known in Australia is *Libythea myrrha*, Godt., a dark-brown insect with white and tawny markings. It is also found in Northern Queensland, Borneo, Java, and Continental India. In Australia it is very rare.

LYCÆNIDÆ.

The caterpillars are shaped like wood-lice, and are inactive flat creatures. They are broadest and thickest about the middle, often corrugated or roughened above, and sometimes furnished with dorsal projections or fascicles of hair. Chrysalis short and robust, usually attached by the tail, and a girdle across the middle. A few rare instances are known in which the chrysalis is found free, either under stones or buried in the earth.

This family contains a vast number of species, mostly of small size, which are remarkable for the brilliancy of their colouring, especially in the males. The family is a very distinct and natural one, the want of joints in the first or anterior pair of legs in the male being an almost invariable characteristic. The same cannot be said of the limitations of the genera, for in spite of the labours of many eminent entomologists, no very satisfactory scheme of classification has been proposed. In Australia alone more than 80 species, representing 15 or 16 genera, have been found, but this number will no doubt be largely increased, when the more remote localities have been better searched. Many of the Lycænidæ are furnished with "tails" on the hind-wings, generally simple thread-like projections, but sometimes exhibiting a high degree of development, and becoming fringed and twisted. Some species have one of these tails on each side, others two or three. Although active on the wing, they do not indulge in sustained flights, but prefer rather to flit from flower to flower.

In most cases the males, as is almost always the case amongst insects, exceed the females in brilliancy of colouring ; but although the sexes of the same species of Lycænidæ often display great differences in the colours of the upper side, there is always a wonderful agreement in the colouring and pattern of the underside. On this account the cabinet naturalist relies almost entirely upon the characters of the underside, when endeavouring to

identify the sexes of the various species. Perhaps no other family of butterflies presents such an infinite variety of tints. Every shade of purple, violet, green, and red, is found, but brilliant blue and metallic hues predominate, a fact which has given rise to their popular names of "blues" and "coppers"

DANIS TAYGETUS, Feld. (Male).
White-banded Blue.

HOLOCHILA ABSIMILIS, Feld.
Pencilled Blue. (Female).

The Australian species are too numerous to enumerate here. Besides Zeritis and Lucia, two genera containing more or less metallic species, we have a large number of the ordinary type of "blue," formerly known as Lycæna, but now subdivided into a number of genera, of which Danis, Holochila, Lampides, Lycænesthes, and Pithecops are the most important. Most of the species are of small size, and some of them are furnished with tails. They are usually local in their distribution, but a few have a tolerably wide range on the east coast, and one well-known species, *Lycæna boetica*, Linn., is cosmopolitan. The following are common Sydney species of this group :—*L. phœbe*, Mur., *H. absimilis*, Feld., *D. taygetus*, Feld., *L. alsulus*, H.S., and *P. xanthospilos*, H.S. Allied to the common type of "blue," but distinguished by having hairy eyes, is Chrysophanus, containing the common *C. erinus*, Fabr., the Blue Mountain *C. cyprotus*, Oll., *C. Heathi*, Cox, and one or two other species, including some recently described from West Australia by Mr. Meyrick. Miletus, or Hypochrysops, contains some half-dozen highly coloured species, with brilliant metallic markings on the undersides. The

best-known species is *M. ignitus,* Fabr. The genus Ialmenus, containing seven species, is remarkable for the high development of the tails or appendages of the hind-wings.

Ialmenus evagoras, Don.
Imperial Blue.

The species are mostly found in Queensland, but one, *I. evagoras,* Don., is common about Sydney. Another, *I. myrsilus,* Dbl., appears to be confined to Tasmania.

The remaining Australian genera of Lycænidæ are composed of large and brilliantly coloured species, mostly found in Queensland and the northern parts of New South Wales, of which the majority have been admirably figured by Mr. Hewitson. Utica contains a single species, Deudorix three, and Amblypodia two. Ogyris contains nine species, which are of a more robust structure than the other members of the family. *Ogyris abrota,* Hew., and *O. amaryllis,* Hew., occur in New South Wales. *O. idmo,* Hew., is found in West Australia. The life-history of *Ogyris genoveva,* Hew., the finest species of the genus, has been

published by Mr. Miskin from information received from Mr. Barnard. The larva is of the usual slug-like type, with each segment provided at the side with a fascicle of bristles; in colour it is ochraceous, the dorsal surface of the segments being brown at the base, and the spiracles black. It is evidently of social habits, as a large number were found feeding by night on its food-plant, a species of *Loranthus*. In the day time the larva is said to hide itself under the surface of the soil, where it finally undergoes its transformations. The larvæ of some species of Lycænidæ, both native and foreign, are frequently attended by ants, who seek their company for the sake of a sweet secretion which they emit. This curious phenomenon has been observed by Mr. Barnard to occur in the case of several Australian species, notably in *Ogyris genovera*, Hew., *Ialmenus evagoras*, Don., and *I. ictinus*, Hew.

PAPILIONIDÆ.

The caterpillars vary considerably in form, but are usually subcylindrical or slender and tapering at either end; in the first sub-family, the Pierinæ, they are always of the latter form and are more or less pubescent; in the second sub-family, the Papilioninæ, they are more robust, and are provided on the first segment of the thorax with two retractile tentacula, which the animal has the power of protruding at will. The chrysalis has the head angular or pointed in most of the Pierinæ, and bifid, truncate, or rounded in the Papilioninæ; in both groups it is secured by the tail and a girdle across the middle.

Pierinæ.

The characters which distinguish these insects from those of the succeeding sub-family are the presence of a sort of channel, formed by the abdominal margin of the hind-wings for the reception of the body or abdomen, the absence of elongated spurs on the tibiæ of the forelegs, and certain differences in the neuration or wing-veining.

The group is of world-wide distribution, and is represented in Australia by more than 50 species, including some small white butterflies, which take the place of the "garden whites" of English collectors. The wings vary considerably in colour, but white and various shades of red and yellow decidedly predominate. Often the upper and under sides of the wings present striking contrasts in colour, as in the species of Delias, Appias, and Belenois.

The genus Elodina contains a few delicate pearly-white species, with dusky tips to the fore-wings. Of these the *E. angulipennis*, Luc., and *E. parthia*, Hew., are the best known. The former feeds on various species of Capparis, and is very common in the neighbourhood of Sydney. The allied genus, Terias, contains about a dozen bright yellow species, which have the fore-wings almost always, and the hind-wings frequently, edged with brown or black. The range of the species is often very wide, and they are subject to considerable variation in the width of the borders and the markings of the underside. The limits of the species are very ill-defined, and consequently the genus presents great difficulties to the systematic entomologist. About Sydney two or three evidently distinct species are to be found. Of these

Terias smilax, Don.
Australian Yellow Butterfly.

Terias smilax, Don., is the most abundant. It will be easily recognised on account of its small size and the absence of a dark border to the hind-wings.

The species commonly known as "whites" belong to the genera *Delias, Appias, Belenois*, and *Tachyris*. Formerly they were all included in the old genus *Pieris*. In this group of butterflies the colouring of the wings is as various as in any known division, and usually in the Australian species the upper and under surfaces offer striking contrasts. The females have the upper side much darker than the males, and are almost always provided with more extensive and conspicuous markings, characters which are distinctive of the sex in many groups. The larvæ have a partiality for Cruciferæ and Capparideæ; but they do not by any means confine themselves to plants of those orders. In Europe some of the species of true *Pieris* are frequently very destructive in vegetable gardens, where they devour the cabbages and turnips. The curious migratory flights in which several species of this group of butterflies—notably *Delias nigrina*, Fabr., and *Belenois teutonia*, Don.—occasionally indulge are but little understood. Immense clouds of butterflies were observed during the early part of last summer in the Liverpool Plains district, passing from west to east, but unfortunately the species does not appear to have been identified. It is to be

hoped that in future any resident in the bush—for it appears that it is chiefly from residents in the bush that accounts of these flights find their way into the newspapers from time to time—who may witness these migratory flights, will preserve specimens and submit them to some competent entomologist for identification.

DELIAS NIGRINA, Fabr. (Male).
Migratory White.

The genus Delias is represented by seven or eight species, of which *Delias nigrina*, Fabr., one of the most common Sydney butterflies, is figured in our illustration. Above, the male of this species is white, usually more or less dusky, with a large black patch at the apex of each of the fore-wings, which is relieved by three or four obscure markings. The female is more dusky above, with the entire apical half of the fore-wing, and a broad marginal border on the hind-wing, black. Beneath, both sexes are coloured alike. The fore-wings are deep black, inclining to gray near the inner margin, with a broad

yellow band near the tips ; the hind-wings are dark gray, marked with black, and are provided with an irregular flexuous carmine band on the middle of each wing.

D. NIGRINA
Larva and Pupa.

The larva—a dull green creature, with a row of minute yellow spots on each side, each emitting a long white bristle —is found abundantly on *Loranthus*, in and about Sydney throughout the spring and summer. It lives in companies, feeding, when young, in clusters on a single leaf of its food-plant. The pupa or chrysalis is tawny yellow, and is provided with hook-like processes on the head.

Two other highly characteristic, and, in the south, common species, *Delias harpalyce*, Don., and *D. aganippe*, Don., are found near Sydney. Both feed on *Loranthus* and are double-brooded, the first brood making its appearance in early spring, usually in September, and the second in January or February. The larvæ of *D. harpalyce* are gregarious, living together in large communities, and they appear to seldom wander far from their food. When fully grown they spin a large white web, often three or four inches in width, to which they attach themselves before changing to the pupa state. Thirty or more of these pupæ may be found on a single web, attached by the tail and a central girdle, as is usual in this family. *D. aganippe* is not a gregarious species, and the pupæ are unprovided with a web, being found singly attached to their food-plant by the usual girdle.

D. argenthona, Fabr., which was formerly only known as a Sydney species from a single specimen captured at Petersham many years ago, has since the summer of 1886 been comparatively common. In Queensland it is one of the commonest of the "whites." *D. mysis*, Fabr., a tolerably common northern species, is occasionally found as far south as Sydney. As far as we know at present, *D. nigidius*, Misk, and *D. inferna*, Butl. —the latter a singular red species with a blue-black underside—

are confined to Northern Queensland. *Appias ega*, Bois., is a common and widely distributed species. *Belenois teutonia*, Fabr., the best known representative of the third division of the "whites," is found throughout Australia, and is one of those species which is wont to indulge in migratory flights. It feeds on various kinds of caper-trees *(Capparis)*, and, like most of the group, is

DELIAS ARGENTHONA, Fabr (Male).
Tinted Delias.

D. ARGENTHONA (Underside).

double-brooded. The summer brood may be distinguished in this species, as well as in one or two allied ones, by the more decided markings, particularly of the female, and by the brighter colouring of the underside. *B. perimale*, Don., is a pretty little species which is widely distributed in Australia, and is also found in Norfolk Island. The *Eronia iobœa*, Bois., is a very

distinct species, which is only known to me by the original figure and description. It is said by Boisduval to come from North Australia, but, as far as I am aware, it is unrepresented in colonial collections.

C CATILLA (Under.side)

CATOPSILIA CATILLA, Cram. (Female.)
The Larger Catopsilia.

The next genus, Catopsilia, formerly classed with Callidryas, contains six or seven very distinct species, which are creamy-

white or yellow in colour. The best known species are *Catopsilia crocale*, Cram., *C. gorgophone*, Boisd., and *C. catilla*, Cram., the latter a large butterfly, with powerful flight, which is found about Sydney. The male is creamy-white, with the bases of the wings yellow, and the female yellow with very variable greenish markings on the underside. The larva feeds on *Cassia*, a genus of plants for which many of the group have a partiality.

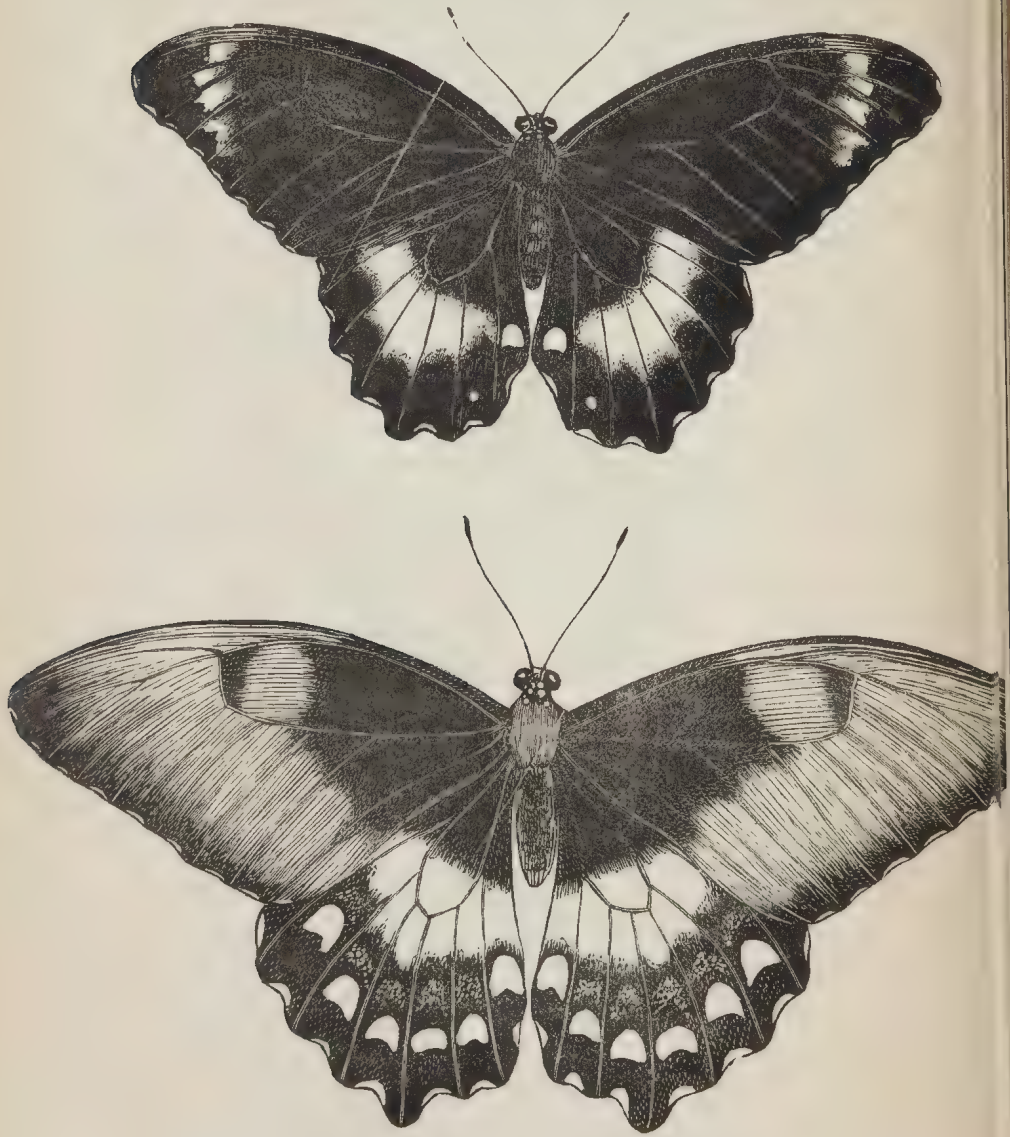
Papilioninæ.

Perfect insect, with the anterior tibiæ spurred, the claws usually simple. Caterpillar stout, cylindrical; the first segment furnished with two retractile tentacula or processes, which the creature can protrude at will.

Eurycus cressida, Fabr. (Male and Female).
Mimicking Papilio.

Three genera of this sub-family occur in Australia—namely, Eurycus, Papilio, and Ornithoptera. Of these the first contains a single species, *Eurycus cressida*, Fabr., which is found in New

South Wales and Queensland. This remarkable form bears a superficial resemblance to *Acræa andromacha*, Fabr., one of the Nymphalidæ, but is, of course, very different in structure. The male has the fore-wings transparent, with chocolate brown mark-



PAPILIO ERECTHEUS, Don. (Male and Female).
Orchard Butterfly.

ings, and the hind-wings chocolate brown, with a creamy white central band, and a row of obscure red spots near the outer margin. The female has both the fore and hind-wings semi-transparent, and is obscurely marked with yellowish brown. The singular abdominal plate or pouch, which we have already noticed in Acræa, recurs in this species, and obtains a high degree of development, plainly indicating a relationship with Parnassius, a genus to which, strangely enough, it bears a striking likeness in colour and pattern. The next genus Papilio contains some of the largest known butterflies. In Australia we have

P. ERECTHEUS (Variety of Female).

about 20 distinct kinds, of which several are common and widely distributed. In this group the wings vary greatly in shape; the fore-wings are mostly triangular, rounded, or falcate, but the hind-wings may be rounded and dentate, ovate or triangular, with tails or without. *Papilio erectheus*, Don., is a familiar species of the group with dentate hind-wings. The male is a brownish black insect, with creamy white markings; the female is larger than her partner, and has the external half of the fore-wing dusky white except on the veins. A row of crescentic red spots near

the hind-margin of the posterior pair of wings is another noticeable distinction between the sexes.

It is the commonest Papilio, and the largest butterfly found near Sydney, where it occurs throughout the summer. Its larva feeds on the orange, and is sometimes so abundant as to cause considerable destruction in orange orchards. The larva, when fully grown, measures about 2½in. A singular variety of the female insect, with the red spots on the hind-wings greatly elongated, was captured by the late Mr. Scott at Ash Island, in the Hunter River, some years ago. It is figured in our illustration.

Nearly allied to the common *P. erectheus* is *Papilio egipius*, Misk., a species which appears to be confined to Northern Queensland. *P. sthenelus*, Macl., is a local species, but is occasionally found near Sydney feeding on *Salvia*. Many lepidopterists have considered it as identical with the common Asiatic species *P. erithonius*, Cr., by which name it is known in most colonial collections, but there seem sufficient grounds for separating it from that species, as it has developed certain characters which appear to correspond to geographical limits. The New Guinea species

PAPILIO SARPEDON, Linn.
The Wanderer.

P. indicatus, Butl., has been observed at Thursday Island by Mr. Mathew, who was fortunate enough, during the stay of H.M.S. Espiègle at Port Moresby, in November, 1884, to witness a flight of these butterflies. He says: "One day, while we were at anchor (we were nearly two miles from the landing-place) a constant stream of butterflies passed the ship, flying across the harbour from south-east to north-west, the harbour being from three to four miles wide. Many thousands must have passed during the

day, and three-fifths of them consisted of this species, the others being different kinds of *Pieris, Euplœa, Libythea, Lycœna,* &c." *P. anactus,* Macl., is found throughout New South Wales and Southern Queensland, but does not seem to be a common species. It feeds on various citrons, including the orange and common lemon. *P. agamemnon,* Linn., is confined to Queensland and the northern parts of New South Wales. *P. lycaon,* Westw., has a wide distribution on the East coast of Australia, extending from

PAPILIO MACLEAYANUS, Leach.
Macleay's Swallow-Tail.

Kiama to Cape York, Thursday Island, and New Guinea. It is not uncommon in the neighbourhood of Sydney, where its larva —an olive-green creature measuring about 1½in. in length—feeds on the custard-apple *(Anona)*. *P. sarpedon,* Linn. (var. *choredon,* Feld.), is common in open, sunny places, such as gardens and waste grounds where flowering plants occur. Its food is the camphor-laurel, on which the parent insect deposits the eggs singly. The larva, when very young, is of a rich black colour, with numerous spines, somewhat resembling those of many Nymphalidæ. On the shoulders are two much larger spines, fringed with hairs, and there are two other pure white ones at the anal extremity. As the larvæ increase in size they lose these spines, except two anterior ones and two at the tail—the colour of the insect now being dull sap-green above, merging into a bluish, ashy hue on the sides. On the third segment, between and connecting the two spines, is a bright yellow band. These colours, although decreasing in intensity and becoming finely

speckled with white, are continued until the insect is full-grown. The spines, however, become smaller, and the lateral band of yellowish-white in the region of the stigmata, or breathing orifices, much more distinct. The larvæ are robust anteriorly, gradually tapering to the tail, and possess retractile tentacula. The chry-

Papilio ulysses, Linn.
Imperial Swallow-Tail.

salis is attached by the tail and a central band, about $1\frac{1}{4}$in. in length, and is of a pale green colour, speckled with darker markings. Over the head there is a projection or process of considerable length, from which emanate four hard brownish lines, which proceed, two on each side, until they meet at the tail. We now come to that division of the genus Papilio, commonly called "swallow-tails," which is distinguished by the possession of tail-like appendages to the hind-wings. Of these *P. macleayanus*, Leach, is one of the most distinct. It is found in Tasmania, where it is the only representative of the genus, and throughout the coast districts of New South Wales and Queensland, even extending as far as Lord Howe Island, but it appears to be peculiar to the Australian sub-region. The larva, which feeds on the orange, is

ORNITHOPTERA PRIAMUS, Linn. (Male—Natural Size).
Birds'-wing Butterfly.

O. PRIAMUS (Female—Natural Size)

very sluggish in its habits, but is extremely sensitive, shooting out its tentacula at the slightest alarm. The chrysalis is attached in the usual manner by the tail and a central girdle. *P. amphiaraus*, Feld., is found in Norfolk Island and in New Caledonia, but we have no satisfactory evidence of its presence on the mainland of Australia. *P. capaneus*, Westw., is found in New South Wales and Queensland. *P. ulysses*, Linn., a magnificent metallic-blue and black-bordered species, is not uncommon in many parts of Queensland. *P. leosthenes*, Dbl., represents another type of the genus in which the tails on the hind-wings are long and narrow. It is not uncommon in the northern parts of New South Wales and in the south of Queensland.

The magnificent genus Ornithoptera is represented in Australia by four more or less variable forms belonging to the group in which the males are velvety black, with golden green markings. These forms have been characterised as distinct species under the names *O. poseidon*, Dbl., *O. cassandra*, Scott, *O. pronomus*, Gr., and *O. richmondia*, Gr., but as the differences between them are entirely those of colour, depending on the size and position of the green markings on the fore-wings, most entomologists now regard them as mere varieties of the old Linnean species, *Ornithoptera priamus*, a conclusion which is borne out by what we know of their early stages. It has been stated that the various forms are peculiar to certain localities, but I find upon a careful examination of the specimens contained in the local collections, that this statement, as far as Australia is concerned, is not founded on fact, although it appears that the further we travel north the larger and more conspicuous are the green markings. With us the butterfly ranges from the Richmond River, in New South Wales, to Cape York, and it is known to extend as far as Amboyna. At Darnley Island, when in the "Chevert," Mr. W. Macleay obtained the larva of the form of *O. priamus* known as *O. poseidon*, and I find that it agrees in every particular with the caterpillar of the form *O. pronomus*, recently described by Mr. Mathew, from Thursday Island. Indeed there appears to be little difference, except in minute points of colour, between these larvæ and that of the very distinct species, *O. urvilliana*, Gn., from the Duke of York Islands. They are all dull black creatures, about two inches long, with conspicuous carmine dorsal spines which are black at their base and tips, and a row of black spines at the sides near the spiracles or breathing orifices; the seventh segment has the dorsal spines white and somewhat enlarged at the base, where they are joined by oblique white stripes, which terminate on each side at the base of the preceding segment. These caterpillars feed on *Aristolochia*. The male butterflies—as indi-

cated above—are rich velvety black, with brilliant, almost golden green markings ; the hind-wings are green. The females are brown, with dusky white markings. From their large size and powerful flight these beautiful creatures have received the name of "birds'-wing butterflies," a title which they certainly deserve, as they are among the finest and most brilliantly coloured of the butterflies of the old world. Our species is the largest Australian butterfly. The women of Darnley Island are said to use the living butterflies as ornaments, fastening them by a thread to their hair, and allowing them to flutter about their heads.

HESPERIIDÆ.

The caterpillars of this family are long, cylindrical, fleshy creatures, usually with a large head. Chrysalis generally smooth, attached by the tail and a central girdle secured by many threads, or enclosed in a slight cocoon between the rolled leaves of its food-plant.

This family contains a vast number of mostly small and obscurely coloured species, which, from their irregular flight, are popularly known as "skippers." In their structure as well as in their transformations they approach the moths. A character in which a large number of the family differ from all other butterflies consists in the presence of two pairs of spurs on the hind tibiæ, but it is not one which will serve for the differentiation of the group, as instances are known in which one or both pairs are wanting. In Australia there are at present rather less than 70 known species ; of these a considerable number have been found during the last few years, and no doubt many more remain to be discovered. Ismene contains about six moderately large species, of which *I. discolor,* Feld., and *I. exclamationis,* Fabr., are the most common, but I am not aware that they occur as far south as Sydney. Netrocoryne contains two conspicuous species, *N. denitza,* Hew., and *N. repanda,* Feld., the former perhaps the finest "skipper" found in this country. *N. repanda* is found about Sydney, feeding on *Eugenia.* The genera Pamphila, Telesto, Apaustus, Trapezites, and Hesperilla, contain a large number of species which it is impossible to treat of in the space at my disposal. *P. phineus,* Cr., is found throughout Australia wherever palms occur in a state of nature or are cultivated. *P. augias,* Linn., *P. symmomus,* Hubn., and *A. agraulia,* Hew., are well known species. *Hesperilla picta,* Leach, and *H. ornata,* Leach, two local species which feed on *Cladium,* are found near Sydney. Taractrocera has three representatives in Australia,

and the genus Euschemon, a single fine black and yellow species known as *E. Rafflesiæ*, which was described by Mr. W. S.

EUSCHEMON RAFFLESIÆ, Macl.
Raffles' Skipper.

NETROCORYNE DENITZA, Hew.
Giant Skipper.

HESPERILLA ORNATA, Leach.
Spotted Skipper.

Macleay from specimens obtained by Admiral King whilst surveying in North Australia. The species is found as far south as the Richmond River, but it appears to be decidedly rare.

A CHAPTER ON COLLECTING AND PRESERVING INSECTS.

In giving a few simple directions for collecting and preserving insects, I think I had best confine myself to describing the methods employed by myself. I go out provided with a net made of silk gauze or book muslin, a cork-lined box provided with pins, and an assortment of pill-boxes. The morning is the best time for butterflies and day-flying moths, but for the majority of the species, and particularly for the smaller kinds, I prefer the hour before dark. Many species are then on the wing that do not stir at other times. I watch the stems of flowers, the twigs of trees, disturb leaves and shrubs, securing each moth as it takes wing. Searching tree trunks and sheltered palings is often most productive, and a lamp placed in a conspicuous place after dark nearly always yields good results. Butterflies should be killed without removal from the net by a sharp nip applied to the muscles, which are situated at the base of the wings, with the finger and thumb. If this is done when the wings are over the back of the butterfly, very little evidence of the rough usage will be left. Thick-bodied species are best killed by means of a killing bottle, which may be made by taking a wide-mouthed bottle with an air-tight bung and placing three or four pieces of cyanide of potassium at the bottom, and over this a thin layer of plaster of paris, mixed with a sufficient quantity of water to make it of about the consistence of thick cream. A few pieces of cyanide with a pad of blotting paper tightly pressed down over them will answer very well if the plaster of paris cannot be obtained. Moths can also be killed in the fumes of ammonia, chloroform, or benzine. Butterflies should be placed in paper envelopes, folded in a triangular form, but care must be taken that their wings are brought in contact over their backs. A number of these envelopes packed in a biscuit or similar tin, will travel any distance with perfect safety. All moths should be pinned through the centre of the thorax, and large species should have the contents of the abdomen removed. This is readily done by making a longitudinal incision on the underside of the body, removing the contents, and substituting a little cotton wool.

The small moths (Micro-lepidoptera) must be pinned. They should be brought home alive in pill-boxes and killed in the cyanide bottle, or the boxes (having previously had a small hole bored in the bottom) may be placed in a tin canister with a small piece of sponge or blotting paper moistened with chloro-

form or strong liquid ammonia, and left until the following morning, when they should be pinned. The best way of collecting these little moths is to disturb leaves and low-growing plants, securing them as they fly out and placing each specimen in a separate pill-box.

Beetles, or Coleoptera, are to be found everywhere. Flowers, leaves, decaying vegetable matter, and seaweed, moss, fungi, and dead trees abound with them. Many are found lurking under stones and under bark, and others frequent carrion, which they assist in removing. Perhaps searching flowers and bottling the specimens when seen, beating shrubs and low-growing trees over a net or inverted umbrella, and searching beneath loose bark and under fallen logs and stones, are the easiest and most profitable ways of collecting.

The following method of preserving beetles is the one generally adopted by collectors who are travelling from place to place, as it not only kills the insects, but preserves them in excellent condition as soon as they are captured. The specimens, when collected, should be placed in a wide-mouthed bottle, about one-third filled with sawdust, containing a small piece of cyanide of potassium, which, it should be recollected, is a deadly poison. The sawdust should be sifted through coarse muslin, and the chips rejected, and should, if possible, be of some light wood containing little colouring matter. When the day's collecting is over, the insects contained in the collecting bottle should be transferred to a tin canister or stock bottle, which has been prepared by placing a layer of sawdust at the bottom, similar to that used in the collecting bottle. The sawdust should be slightly damped, not soaked, with a mixture composed of 19 parts of methylated spirit or benzoline, and one part of carbolic acid. Another layer of sawdust should then be added, then another layer of beetles, and so on alternately until the tin is full. Tin canisters are to be preferred on account of their being free from the danger of breakage ; but any kind of wide-mouthed bottle, or pickle jar, will answer every purpose if it is provided with a tightly-fitting bung. If this plan is from any reason found to be impracticable, the beetles may be brought home alive in the collecting bottle and then dropped into boiling water, when death is instantaneous, or they may be killed by being placed in a bottle with a few drops of chloroform on a piece of blotting paper or cotton wool.*

*In localities where the common European laurel is found, a killing-bottle for beetles may readily be made by taking a wide-mouthed bottle and partly filling it with finely-chopped laurel leaves. If only the young leaves and shoots are used, the laurel will last for many months, and it has the advantage not only of killing the specimens, but of preserving them in a relaxed condition for almost any length of time.

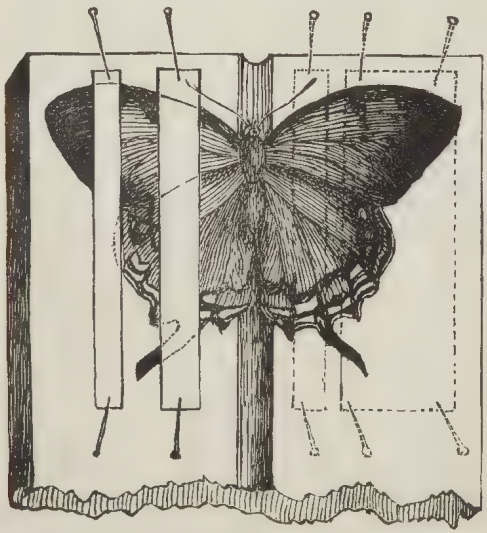
Lastly, the beetles, with any other insects possessing hard integuments, can be preserved in alcohol.

Diptera (flies), Hymenoptera (bees, wasps, &c), Neuroptera (dragonflies, mayflies, &c.) and all pubescent insects should be pinned. They may be killed in the same manner as the moths.

Orthoptera (grasshoppers, walking-stick insects, &c.) and Hemiptera (plant-bugs) are best preserved in spirit, although the latter may with safety be packed in sawdust with the beetles.

Mounting or setting butterflies and moths (*i.e.*, spreading out their wings, antennæ, &c.) is by no means as difficult a process as some people suppose, and the necessary apparatus is neither elaborate nor costly. A few grooved boards of soft wood or cork, a pair of steel forceps, a few strips of narrow paper, and some pins are practically all that is required. Besides the forceps, which are dispensed with by many, except when dealing with the smaller moths, and the pins, none of these things need be purchased.

The grooved, or "setting" boards, as they are called, are made of narrow strips of soft wood of about a foot in length, and are used in strapping down the wings of the insects, until



SETTING-BOARD.

they become dry and fixed. These boards should be of varying widths corresponding to the size of the insect to be "set" or strapped out upon them, and should have in the centre a groove,

also varying according to the size of the insects, on the bottom of which a strip of cork or pith is securely glued. The most satisfactory boards are those which are entirely covered with cork; indeed, when very fine pins are used, as in the case of the smaller moths, it is indispensable that the boards should be covered with cork. With regard to pins, it is of course necessary to have a few packets of those made specially for entomological purposes. These may be obtained from a dealer in natural history apparatus, or from any respectable furrier. And now a word as to setting itself. Having pinned our insect with a pin of suitable size through the centre of the thorax between the bases of the wings, we select a setting board of suitable width, and pin our insect in the central groove. Then, having placed the legs in position, we set out the wings of one side and strap them down by pinning across them narrow strips of paper, which have already been prepared for the purpose. Next, we repeat the process on the other pair of wings, and apply as many strips of paper as we consider necessary. Finally, we set out the antennæ, and support the body if it requires it with crossed pins. The insects should be left on the setting boards until they are perfectly dry. The length of time required to effect this will, of course, vary according to the weather, but in this dry climate they may usually be removed in three or four days. The several methods of setting vary considerably in detail, and almost every collector has some pet plan of his own, but the simple process described above will be found to answer all requirements, at any rate in the case of the butterflies and larger moths. For the Micro-lepidoptera or small moths it will be found advisable to substitute "braces" for the strips of paper. These are made by cutting a sheet of stiff white paper—ordinary note paper will do very well—into pointed pieces of varying lengths.

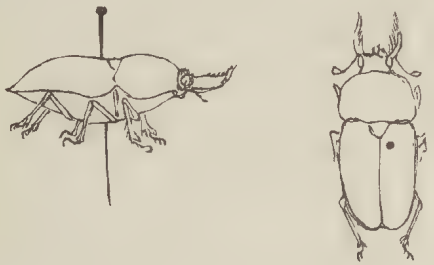
The plan recommended and described by Lord Walsingham in the "American Naturalist" may be adopted for the Micro-lepidoptera. After giving particulars as to the method of killing the moths, and stating that each specimen should be brought home alive in a separate pill-box, the method of setting these minute but interesting creatures is described as follows:—"Taking the lid off a box, and taking the box between the finger and thumb of the right hand, I roll out the insect on the top of the left thumb, supporting it with the top of the fore finger, and so manipulating it as to bring the head pointing towards my right hand and the thorax uppermost. Now I take a pin in the right hand, and resting the first joint of the middle finger of the right against the projecting point of the middle finger of the left hand to avoid unsteadiness, I pin the insect obliquely through the

thickest part of the thorax, so that the head of the pin leans very slightly forward over the head of the insect. After pressing the pin far enough through to bring about one-fourth of an inch out below, I pin the insect into the middle of the groove of a setting board, so that the edge of the groove will just support the undersides of the wings, close up to the body, when they are raised upon it. The board should be chosen of such a size, as will permit of the extension of the wings nearly to its outer edge. The position of the pin should still be slanting a little forward. The wings should now be raised into the position in which they are intended to rest, with especial care in doing so not to remove any scales from the surface or cilia of the wings. Each wing should be fastened with a brace long enough to extend across both, the braces being pinned at the thick end, so that the head of the pin slopes away from the point of the brace; this causes the braces to press more firmly down on the wing when fixed.

"The insect should be braced thus: the two braces next the body should have the points upwards, the two outer ones pointing downwards and slightly inwards towards the body, and covering the main portion of the wings beyond the middle. Antennæ should be carefully laid back above the wings, and braces should lie flat, exercising an even pressure at all points of their surface. The fore-wings should slope slightly forwards so that a line drawn from the point of one to the point of the other, will just miss the head and palpi. The hind-wings should be close up, leaving no intervening space, but just showing the upper angle of the wing evenly on each side." Later on in the same article, Lord Walsingham says: "Half the battle is really in the pinning. When an insect is pinned through the exact centre of the thorax, with the pin properly sloped forward, the body appears to fall naturally into its position on the setting board, and the muscles of the wings being left free are easily directed and secured; but if the pin is not put exactly in the middle, it interferes with the play of the wings. Legs must be placed close against the body, or they will project and interfere with the set of the wings. Practice, care, and a steady hand will succeed."

To set butterflies which have been preserved in paper envelopes, or any specimens which have become dry, it is first necessary to relax them in a jar or tin of damp sand. The best plan is to procure a shallow earthenware pan, with a cover of some kind, and then to place the insects in it on a layer of damp sand. If the insects are placed in the pan overnight, they will be found in good condition for setting in the morning. A few drops of carbolic acid, added to the water with which the sand is damped, will effectually prevent the growth of mould.

Beetles give much less trouble in their preservation. It is sufficient in the case of the larger kinds—those measuring a quarter of an inch and upwards—to pin them through the right wing-case, or elytron, near the shoulder. The pin should be inserted at a point which will ensure its emerging behind the second pair of legs, after passing through the body of the insect, and only about one-fourth of its length should be visible from above. The smaller beetles should be mounted on card. The



BEETLE (LAMPRIMA), SHOWING POSITION OF PIN.

process is simple enough. A solution of gum-tragacanth (which can be obtained at any druggist's) is made by dissolving a few clear pieces of the gum in cold water. When the tragacanth is thoroughly dissolved, a small quantity of ordinary gum arabic should be added, to render it more adhesive. The beetles should then be attached by means of this mixture to thin white card, with their legs and antennæ displayed as neatly as possible. When the insects are dry they should, if mounted in a row, be separated, and all superfluous card cut away, each specimen being left at the extremity of a parallel-sided strip of the necessary width; these narrow strips have now to be pinned near the hinder margin, and the specimens are ready for the collection. Beetles which have become rigid can be relaxed for pinning or carding by a short immersion in boiling water, even years after their capture. Whilst so much remains to be done in Australian entomology, it is sheer waste of time to arrange or "set" the limbs of beetles in the manner supposed to be natural when the insects are at rest. A collector will spend the time more profitably in observing the habits of insects, or in adding fresh captures to his stores. The collection, whether of butterflies, moths, or beetles, should be arranged in the cabinet or store box, which must be dust-proof and air-tight, and should be lined with cork covered with white paper. If proper store boxes cannot be procured, specimens may be temporarily arranged in cigar boxes, which have had split winecorks glued at intervals along their

bottom. To keep away insect enemies, such as mites, and the dreaded museum-beetle Anthrenus, which is so destructive to natural history collections of all kinds in this country, it is necessary to put a small quantity of napthaline or camphor in each box. This may be done by wrapping the napthaline in a small piece of soft muslin, and fastening it securely with strong pins in a corner of the box. If by any chance the Anthrenus should be found to have made its way into a collection, it may be killed with chloroform, ammonia, or better still, with the poisonous fumes of bi-sulphide of carbon. In conclusion I would impress upon anyone about to form a collection, the necessity of attaching to each specimen a label showing the locality from whence it came. Many collections made by beginners with great labour, and at a cost of much valuable time, have lost half their value from neglect of this simple but important detail.

NATIONAL MUSEUM MELBOURNE

GLOSSARY OF TECHNICAL TERMS USED IN THIS PAPER

Anal—Relating to the extremity of the abdomen or body.
Antennæ –Jointed organs (feelers) situated on the head.
Caterpillar—The second stage of the butterfly's life.
Chrysalis –The third, or quiescent stage of the butterfly's life.
Cilia—Fringes.
Claws—Hooked appendages to the feet, or tarsi.
Falcate—Sickle-shaped.
Fascicle –A little bunch or cluster of hairs or scales ; a tuft.
Fauna—The assemblage of animals inhabiting a region or country.
Femur—Thigh.
Fulvous—Tawny.
Fuscous—Dark brown, approaching black.
Larva—See Caterpillar.
Margin—Outer edge.
Nervures—The branching ribs which form the support of the wings.
Ochreous—Of the colour of ochre.
Palpi (labial)—Jointed organs of the mouth, attached to the under lip, or labium.
Pubescent – Downy.
Pupa—See Chrysalis.
Spiracle—Breathing orifice.
Stigma, Stigmata—See Spiracle.
Tarsus -Foot.
Tentacula—Retractile organs situated on the dorsal surface of certain caterpillars.
Thorax –The second division of the body, bearing the wings and legs.
Tibia—Leg.
Truncate Cut straight across.

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